REMARKS

Applicant submits a Petition and Fee for a One-Month Extension of Time.

Claims 1, 5, 31, 34, 37-38, 40-47, 49, 53 and 57-59 are all the claims presently pending in the present Application. Claims 1, 5, 41, 42 and 49 have been amended to more particularly define the claimed invention. Claims 57-59 have been added.

It is noted that the amendments are made only to more particularly define the invention and not for distinguishing the invention over the prior art, for narrowing the scope of the claims, or for any reason related to a statutory requirement for patentability. It is further noted that, notwithstanding any claim amendments made herein, Applicant's intent is to encompass equivalents of all claim elements, even if amended herein or later during prosecution.

Claims 1, 5, 31, 34, 37-38, 40-47, 49 and 53 stand rejected under 35 U.S.C. §103 (a) as being unpatentable over Yau et al. (US Patent No. 6,054,379) in view of Allada et al. (6,218,317 B l) and further in view of the Alleged Admitted Prior Art (AAPA).

These rejections are respectfully traversed in view of the following discussion.

I. THE CLAIMED INVENTION

The claimed invention (e.g., as recited, for example, in claim 1 and similarly recited in claims 5, 41-42 and 49) is directed to a semiconductor device, including a multi-layered insulation film formed on a semiconductor substrate, the multi-layered insulation film including a methyl silsequioxane (MSQ) layer, a methylated hydrogen silsesquioxane (MHSQ) layer formed on and being in contact with the MSQ layer, and an inorganic insulation layer formed on the MSHQ layer and including a member selected from the group consisting of silicon oxide, silicon nitride and silicon oxynitride, the inorganic insulation layer including an uppermost layer of the multi-layered insulation film, such that the MHSQ layer inhibits a peeling away of the inorganic insulation layer. The device also includes a plurality of wires which are formed in grooves formed in the multi-layered insulation film, the MSQ layer, MHSQ layer and inorganic insulation layer of the multi-layered insulation film filling a space between the wires.

Conventionally insulating layers may include an inorganic insulating layer (e.g., a

silicon oxide layer) on an organic insulating layer. However, in devices formed by such conventional methods, during a subsequent planarizing step, peeling occurs at the interface between the organic and inorganic insulating layers, which can result in cross-talk between wires (e.g., wires which are separated by the insulating layers) in the semiconductor device (Application at Figure 5; page 2, lines 12-27; page 6, line 13 - Page 7, line 8). Other conventional insulating layers include BPSG (Application at Figure 9(b)), but BPSG has a poor gap-filling characteristic.

An exemplary aspect of the claimed invention, on the other hand, includes an inorganic insulation layer formed on the MSHQ layer and including a member selected from the group consisting of silicon oxide, silicon nitride and silicon oxynitride, the inorganic insulation layer including an uppermost layer of the multi-layered insulation film, such that the MHSQ layer inhibits a peeling away of the inorganic insulation layer (Application at Figure 1). Thus, for example, during a planarization of a surface of the inorganic insulation layer and a surface of the plurality of wires, the MHSQ layer inhibits a peeling away of the inorganic insulation layer.

II. ALLEGED PRIOR ART REFERENCES

The Examiner alleges that Yau would have been combined with Allada and the AAPA to form the invention of claims 1, 5, 31, 34, 37-38, 40-47, 49 and 53. Applicant submits, however, that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

In contrast to Yau which is directed to a method of depositing an oxidized organo silane film, Allada is intended to address the problems involved with forming an undoped silicon glass (USG) hardmask on a polymer-insulated material without taking out a wafer from a spin-truck device, by producing multilayered wires in which both the hardmask and a layered insulation material are capable of being spin-coated. Further, in complete contrast to Yau and Allada, the AAPA simply teaches forming a silicon oxide film on a methyl silsesquioxane (MSQ) film 2 (Application at page 1, lines 16-21).

Thus, clearly Yau, Allada, and the AAPA have different problems and objects to be solved, and there clearly is no motivation to combine Yau, Allada, and the AAPA as alleged

by the Examiner. In short, Applicant respectfully submits that these references are unrelated, and no person of ordinary skill in the art would have considered combining these disparate references, absent impermissible hindsight.

In fact, Applicant submits that the references provide no motivation or suggestion to urge the combination as alleged by the Examiner. Indeed, these references clearly do not teach or suggest their combination. Therefore, Applicant respectfully submits that one of ordinary skill in the art would not have been so motivated to combine the references as alleged by the Examiner. Therefore, the Examiner has failed to make a prima facie case of obviousness.

Moreover, neither Yau, nor Allada, nor the AAPA, nor any alleged combination thereof teaches or suggests "*an inorganic insulation layer formed on and being in contact with said MSHQ layer and comprising a member selected from the group consisting of silicon oxide, silicon nitride and silicon oxynitride, said inorganic insulation layer comprising an uppermost layer of said multi-layered insulation film, such that said MHSQ layer inhibits a peeling away of said inorganic insulation layer*", as recited in claimsl, 5, 41, 42 and 49 (Application at Figure 1). As noted above, for example, during a planarization of a surface of the inorganic insulation layer and a surface of the plurality of wires, the MHSQ layer inhibits a peeling away of the inorganic insulation layer.

Clearly, these features are not taught or suggested by the cited references.

Indeed, the Examiner attempts to rely on Figure 10H of Yau to support his position, and attempts to equate the oxidized organosilane layer 714 in Yau with the MHSQ layer of the claimed invention. However, Applicant notes that the layer 714 is located between the first intermetal dielectric layer 710 and the second intermetal dielectric layer 722. That is, assuming (arguendo) that the layer 714 is an adhesive layer, the layer 714 would prevent layers 722, 718 and 716 that are stacked on the first intermetal dielectric layer 710 from being removed from the first intermetal dielectric layer 710.

In the claimed invention, on the other hand, the inorganic insulation layer includes an uppermost layer of the multi-layered insulation film and is in contact with the MHSQ layer (Application at Figure 1). Nowhere is this taught or suggested by the cited references, including Yau.

Further, in the claimed invention, the multi-layered insulation film does not necessarily include a second intermetal dielectric layer (such as layer 722 in Yau) or layers 718 and 716. Thus, the thickness of the uppermost layer of the multi-layered insulation film (e.g., the inorganic insulation layer) on MHSQ layer may be less than (e.g., much less than) the total thickness of the layers 722, 718 and 716 formed on the oxidized organosilane layer 714 in Yau. Thus, if the MHSQ layer was absent from the claimed invention, it would likely be easy for the inorganic insulation layer to peel away, but if the layer 714 was absent from the Yau device, then it would likely be difficult for the layers 722, 718 and 716 to peel away.

Therefore, nowhere does Allada or the AAPA teach or suggest an inorganic insulation layer formed on the MSHQ layer and including a member selected from the group consisting of silicon oxide, silicon nitride and silicon oxynitride, the inorganic insulation layer including an uppermost layer of the multi-layered insulation film, such that the MHSQ layer inhibits a peeling away of the inorganic insulation layer. Therefore, neither Allada nor the AAPA make up for the deficiencies in Yau.

Further, with respect to claim 46, the Examiner expressly concedes on page 3 of the Office Action that Yau does not teach or suggest this feature. However, the Examiner alleges that Allada teaches this feature, but this is clearly incorrect.

In fact, to support his position, the Examiner states that:

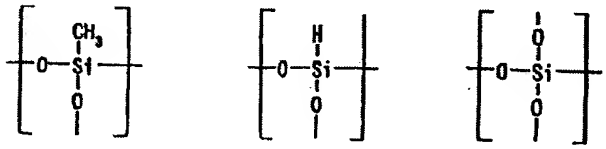
"[a]s to the limitation that the dielectric layer includes repeating units of $(SiCH_3O_2)_n$, $(SiO_2H)_n$ and $(SiO_3)_n$, herein a molar ratio of $(SiO_2H)_n$ to a total of said repeating units is at least 0.2, the dielectric methylated hydrido organo siloxane polymer of Allada teaches upon the recited limitation. See the Response to Arguments section of this office action".

However, in the Response to Arguments section the Examiner simply states that

"[a]s to the limitation that the dielectric layer includes repeating units of $(SiCH_3O_2)_n$, $(SiO_2H)_n$ and $(SiO_3)_n$, wherein a molar ratio of $(SiO_2H)_n$ to a total of said repeating units is at least 0.2, the dielectric methylated hydrido organo siloxane polymer of Allada teaches upon the recited limitation as supported by the provided evidence, (Chen et al. (Effects of slurry formulations on chemical-

mechanical polishing of low dielectric constant polysiloxanes: hydrido-organo siloxane and methyl silsesquioxane)".

That is, the Examiner is not alleging that this feature is disclosed by Allada. Indeed, Allada simply discloses the use of methylated oxide-type materials such as hydrido-organo-siloxane polymer (HOSP) in place of undoped silicon glass (USG) as hard masks. Nowhere does Allada teach or suggest anything about the units included in HOSP. Thus, Allada clearly does not teach or suggest that the HOSP should include repeating units shown by formulae I, II and III



(I) (II) (III)

, and

where a molar ratio of II to a total of I, II and III is at least 0.5. Thus, Allada clearly does not teach or suggest the multi-layered insulation film as in the claimed invention.

However, the Examiner alleges that Chen teaches this feature. This is completely incorrect.

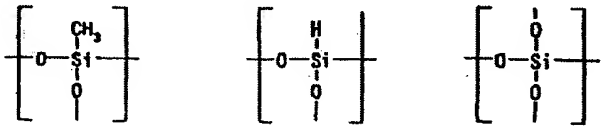
In fact, nowhere does the Examiner identify where in Chen that this feature is taught. That is, the Examiner's rejection is INCOMPLETE and the Examiner must provide Applicant with a complete NON-FINAL Office Action. In particular, Applicant submits that if the Examiner intends to maintain this rejection, the Examiner must provide Applicant with another NON-FINAL Office Action in which the Examiner clearly indicates where this feature is taught or suggested by Chen.

Further, Applicant respectfully submits that Chen would not have been combined with Yau, Allada or the AAPA. Indeed, nowhere has the Examiner identified any suggestion or motivation for combining Chen with Yau, Allada or the AAPA. Therefore, the Examiner has failed to make a prima facie case of obviousness.

In fact, Applicant submits that nowhere does Chen teach or suggest this feature. Instead, Chen simply reports the CMP characteristics of HSQ, HOSP and MSQ.

Presumably, the Examiner attempting to rely on the structural diagram of HOSP in Figure 1 in Chen to support his position. However, the HOSP diagram in Figure 1 depicts a HOSP molecule including 16 silicon atoms (i.e., two cubes having silicon atoms at each of the 8 corners of the cube). However, at most, only 5 of the silicon atoms in Figure 1 in Chen could be considered as a part of the unit shown by formula II above.

Therefore, even assuming arguendo that the HOSP may be somehow confused with an MHSQ layer, Chen clearly does not teach or suggest that the HOSP should include repeating units shown by formulae I, II, and III

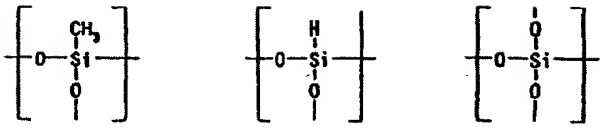


(I) (II) (III)

, and

where a molar ratio of II to a total of I, II and III is at least 0.5. Therefore, like Allada, Chen does not make up for the deficiencies in Yau.

Further, Applicant would again submit that the AAPA does not teach or suggest these features of the claimed invention. Indeed, Applicant would again point out that Figures 8-9 of the present Application simply depict a conventional device including an insulation layer 55 which is formed of BPSG. Nowhere in Figures 8 and 9 or anywhere else, does the AAPA teach or suggest an MHSQ layer including repeating units shown by formulae I, II, and III



(I) (II) (III)

, and

where a molar ratio of II to a total of I, II and III is at least 0.5. Therefore, like Allada and Chen, the AAPA clearly does not make up for the deficiencies

Therefore, Applicant respectfully submits that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention. Therefore, the Examiner is respectfully requested to withdraw this rejection.

III. FORMAL MATTERS AND CONCLUSION

In view of the foregoing, Applicant submits that claims 1, 5, 31, 34, 37-38, 40-47, 49, 53 and 57-59, all the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully submitted,

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